Solar Power Generation Model

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Jul. 2022

Problem Identification

- Solar generation forecasting is crucial for planning and maintaining an efficient grid

- *How can we predict power generation so that plant managers can use project findings for better grid management and to increase the overall efficiency of the system?*

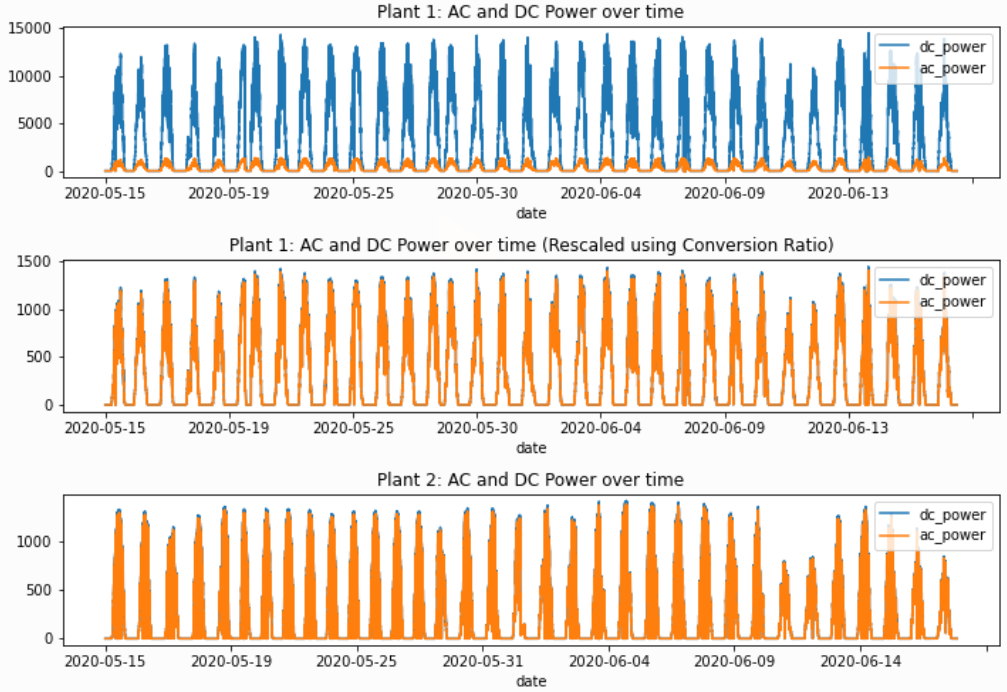
Variables

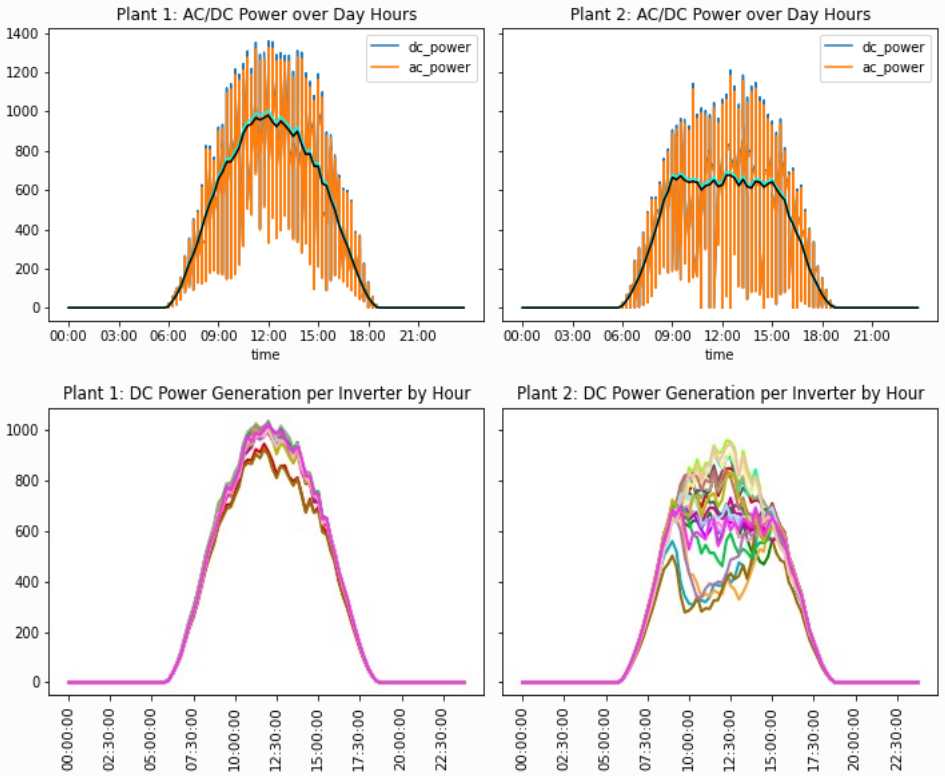
Feature Name	Units	Description
DC Power	kW	The amount of direct current energy generated by the inverter
AC Power	kW	The amount of alternating current generated by the inverter
Daily Yield	kW	The cumulative sum of power generated on that day, till that point in time
Total Yield	kW	The total yield for the inverter till that point in time
Ambient Temperature	◦C	The ambient temperature at the location of the plant
Module Temperature	◦C	The temperature sensor reading of the solar panel module
Irradiation	W/m^2	The amount of light intensity from the sun

AC-DC Power (Scaling...)

The conversion efficiency for solar inverters are typically around 97% to 99%— meaning energy loss is relatively minor…

- Plant 1's AC/DC ratio = 9.78 %
- Plant 2's AC/DC ratio = 97.8 %
- Efficiency Conversion Ratio = 10





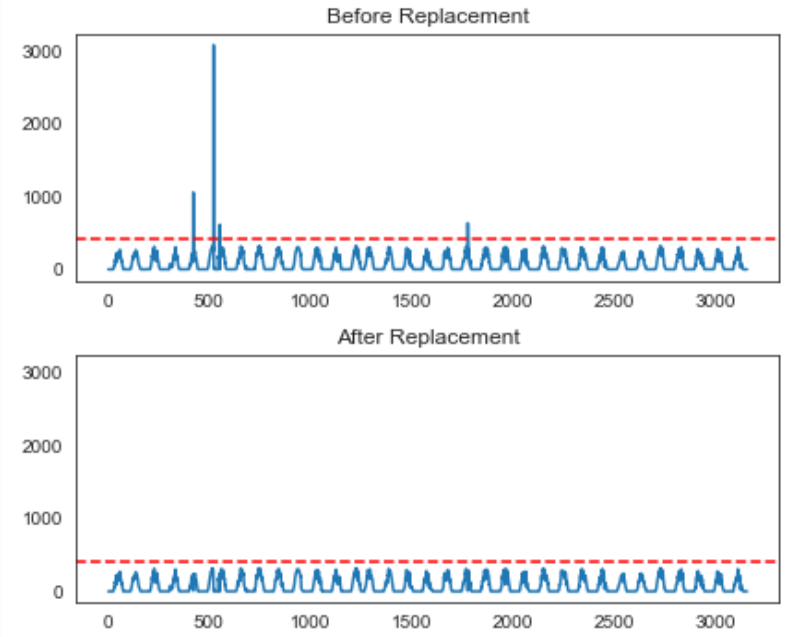
Plant 1:

- Bell Shaped Curve
- Inverters are tightly grouped and stable

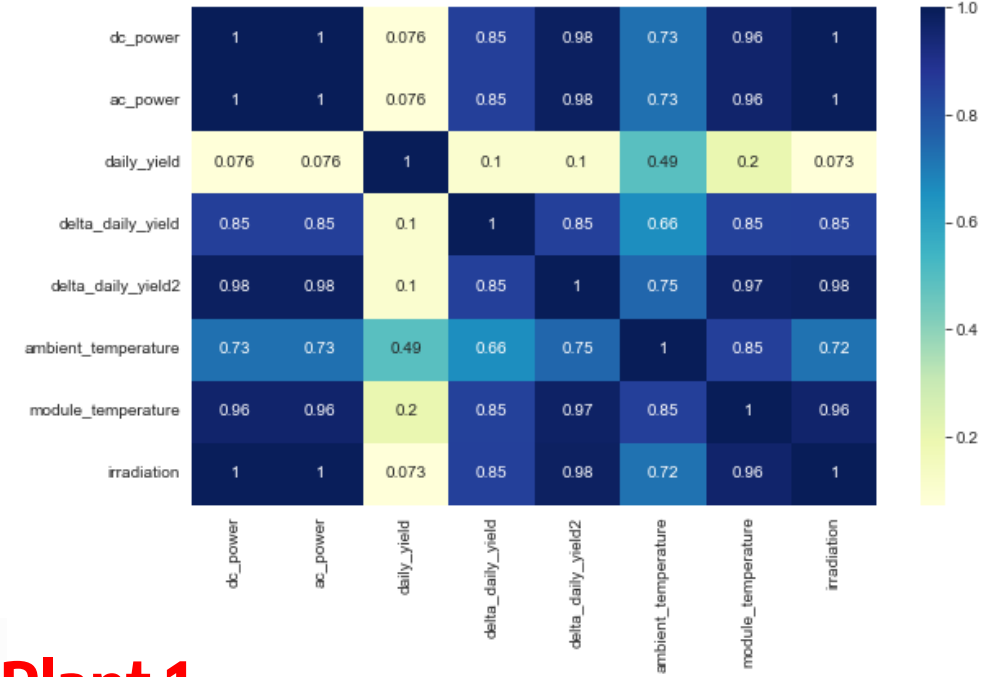
Plant 2:

- Capped at a threshold
- High variability at the inverter level

Handling Outliers

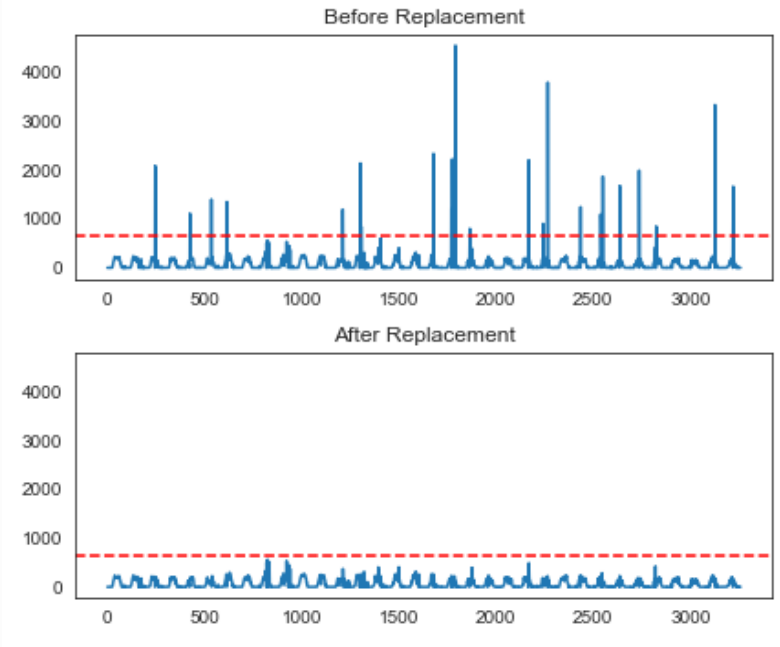


Correlation Heatmap



Plant 1

Handling Outliers



Correlation Heatmap

Plant 2

Modeling
Performance Metrics Evaluation

	r_squared		Mean Absolute Error		Mean Standard Error	
	r2 (mean)	r2 (std)	MAE (mean)	MAE (std)	MSE (mean)	MSE (std)
Plant 1 Models						
Linear Regression	0.9878	0.0019	6.3149	1.4682	90.1842	26.7941
Random Forest	0.9883	0.0025	4.9350	1.7925	88.5963	31.8255
Gradient Boosting	0.9885	0.0033	4.8615	1.8495	86.4643	34.9131

Plant 1

Modeling
Performance Metrics Evaluation

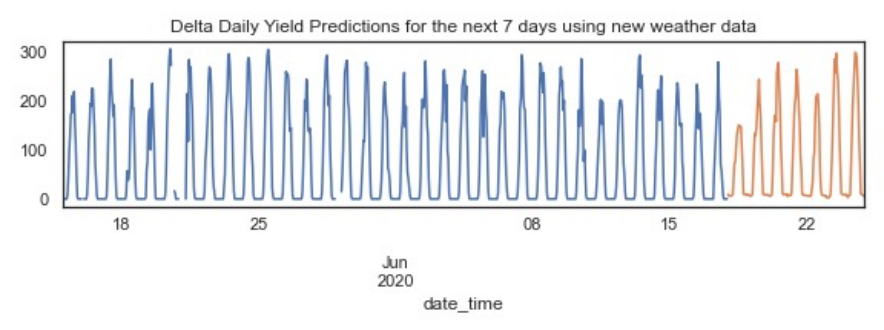
	r_squared		Mean Absolute Error		Mean Standard Error	
	r2 (mean)	r2 (std)	MAE (mean)	MAE (std)	MSE (mean)	MSE (std)
Plant 2 Models						
Linear Regression	0.8433	0.0841	10.9557	8.3594	629.7114	456.1076
Random Forest	0.8171	0.0853	11.9974	8.6789	755.0961	539.4399
Gradient Boosting	0.8210	0.0902	12.4894	8.9215	734.6652	547.2957

Plant 2

Modeling Scenario...

Can we use our model to predict daily yield for the next seven days using weather forecasts?

- Best Model: Gradient Boosting Model
- New weather data: https://weatherdownloader.oikolab.com



date	predicted_daily_yield
2020-06-18	1435.649774
2020-06-19	1861.912548
2020-06-20	2175.264188
2020-06-21	2052.727623
2020-06-22	1546.800547
2020-06-23	2395.338236
2020-06-24	2477.258647